

Unit 1 – Matter: Competencies

0.1 You properly use scientific notation and significant figures. (Record Numbers)

Proficient (75%): *Given a set of numbers, the student can correctly identify the number of significant figures given in each number. The student can accurately convert a number into and out of scientific notation. The student can perform simple addition, subtraction, multiplication and division on two numbers and round the answer to the proper number of significant figures.*

Advanced (100%): *The student accurately applies the concepts of significant figures and scientific notation by rounding answers to ALL numerical problems (slopes, densities, etc.) to within one significant figure of the correct number of significant figures, and properly writing answers to ALL numerical problems greater than 10^3 and smaller than 10^{-4} using scientific notation*

0.2 You consistently make meaningful contributions to the class' online space. (Digital citizenship)

Proficient (75%): *The student makes at least two meaningful postings to the class' online space each week during the marking period and has a total of 27 postings by the end of the marking period. A meaningful posting includes, but is not limited to, a well thought out question that the student would like answered, a detailed answer to another student's question, a well thought out comment on another student's posting, and/or an annotated link to a website or movie that will aid others in understanding the material being learned.*

Advanced (100%): *The student makes at least 4 meaningful postings to the online space each week during the marking period and has at least 40 total postings by the end of the marking period.*

0.3 You are able to use various analogue and digital scales, graduated cylinders and other devices to take accurate data. (Take Measurements)

Proficient (75%): *The student can – accurately measure mass with a triple beam. Demonstrates how to “tare” a digital balance. Can approximate the volume of liquid using a graduated cylinder. Approximates length measurements using a ruler.*

Advanced (100%): *Accurately measures mass with an unfamiliar analogue balance (centigram or other device). Uses the difference in mass between empty and full container to get mass of contents. Reads liquid volumes accurately from the bottom of the meniscus. When measuring with analogue devices a guess is made when reading values between scale markings.*

1.1 You are able to use various equipment and calculations to determine the density of an object. (Density)

Proficient (75%): *Given two of the variables (D , m and/or V) the student can calculate the third value. The student can state if an object will sink or float in water.*

Advanced (100%): *Information about D , m and/or V must be obtained using some other logic, measurement or mathematical operation. Problems involve application of the concept to novel areas, are not straightforward, and may involve more than one object simultaneously. The student will be asked to state if an object will sink or float in a gas or liquid other than water.*

1.2 You can create and interpret visual representations of mass and volume using particles. (Particle Diagrams)

Proficient (75%): The student is able to represent particles using circles - the separation of the particles drawn accurately reflects the density of the material. The student can rank a set of particle diagrams from highest to lowest volume, mass and density when only one of these variables changes at a time.

Advanced (100%):: The student is able to compare and contrast the volume, mass and density of a set of particle diagrams when more than one variable is changing. A set of particle diagrams in which the representations of volume, mass and density are simultaneously changed can be drawn accurately.

1.3 You can create and interpret Mass Vs. Volume graphs. (Density Graphs)

Proficient (75%): The student can graph the mass and volume data provided, and find the density of the material given a graph whose Y-intercept is zero. The student can explain the significance of a Y-intercept of zero.

Advanced (100%):: The student can perform all of the tasks listed for Proficiency, and can also find the density of a material when the graph is created from real, possibly erroneous data that has a non-zero Y-intercept. The student can explain the meaning of the Y-intercept or X-intercept, and can suggest possible reasons for the error.

1.4 You are able to write a formal lab report (Lab Parts).

Proficient (75%): The student's lab report contains a summary of the procedure, ALL of the data obtained recorded in a table or tables, a graph of the data and a conclusion that explains the significance of the findings, a list of possible errors, answers to the questions asked in the lab and suggestions for further research and/or suggestions for improving the lab.

Advanced (100%):: The student's lab report not only has all of the information recorded in the proper sections, but the report is neatly organized, well thought out and demonstrates the student has transferred knowledge from what we have learned in the unit to the completion of the lab.

Unit 1 – Matter: Study Guide

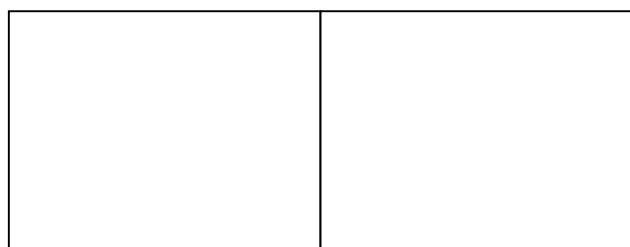
Objectives	
1. Define mass. Define volume. Give appropriate units for each.	
2. Demonstrate that you can use a multiple beam balance to determine the mass of various objects. Record the value of an object's mass in a manner consistent with the limit of precision of the balance.	
3. Represent class data using a histogram; use the histogram to interpret trends in the data. Sketch a sample at right.	
4. Develop, from experimental evidence, the law of conservation of system mass.	
5. Relate the volume of a container (in cm^3) to the volume of liquid it contains (in mL).	
6. Recognize that instruments have a limit to their precision; relate the data recorded to the quality of the measurement.	

7. Round off calculated values to the appropriate number of significant figures.	
8. Given a graph of mass vs volume of a substance, write the equation of the line and state the meaning of the slope.	
9. Recognize that density is a characteristic property of matter . How can density be used to identify unknown substances?	
10. Use density as a conversion factor between mass and volume; show examples of converting mass to volume and vice-versa..	
11. Use particle diagrams to represent solids, liquids and gases in a way that is consistent with their densities.	

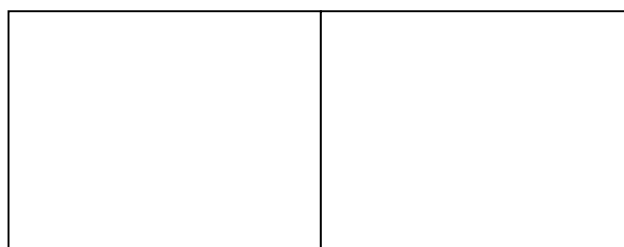
Unit 1 Worksheet 1: Mass and Change

1. When you pulled the steel wool apart, you found that the mass was unchanged. When you heated the steel wool, you found that the mass changed. Explain.

Draw diagrams (at the atomic level) of the steel wool before and after the change.



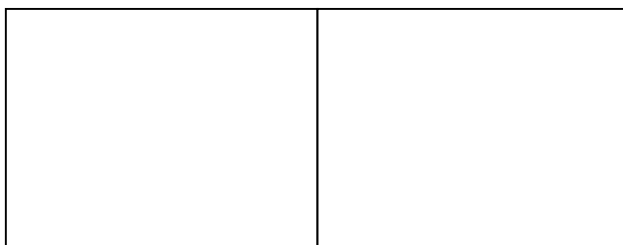
Steel wool-pulled apart
before after



Steel wool-heated
before after

2. When ice melts, the volume of water is smaller than that of the ice. How does the mass of the water compare to the mass of the ice?

Draw diagrams (at the atomic level) of the ice and water. Use small circles to represent the H₂O molecules.



3. When the sugar dissolved in the water, you found that the mass remained unchanged. When the Alka-Seltzer dissolved in the water, the mass of the system changed. Explain.

Draw diagrams (at the atomic level) of each of the materials before and after it was dissolved.

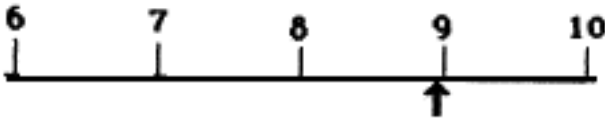
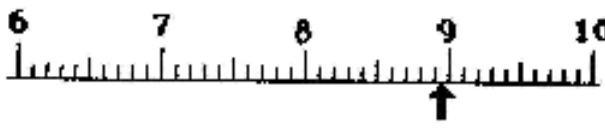
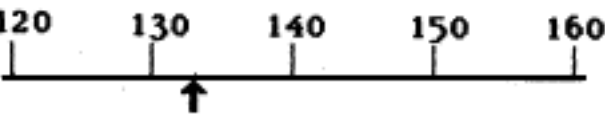
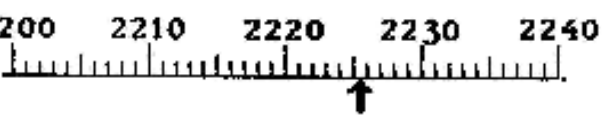
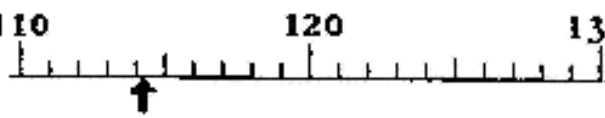
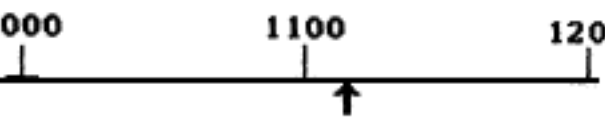
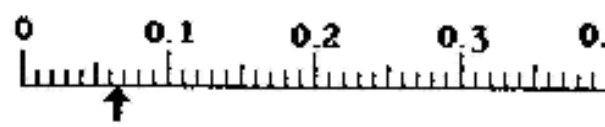
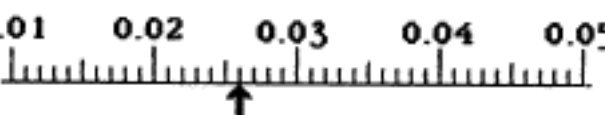
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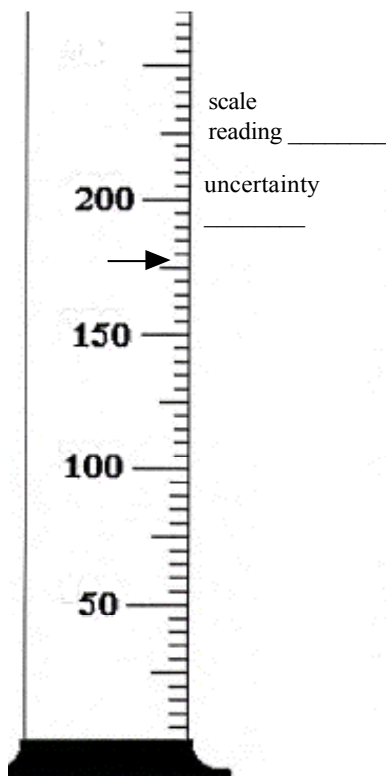
4. State the Law of Conservation of Mass in your own words.

Unit 1: Worksheet 2 - Reading Scales

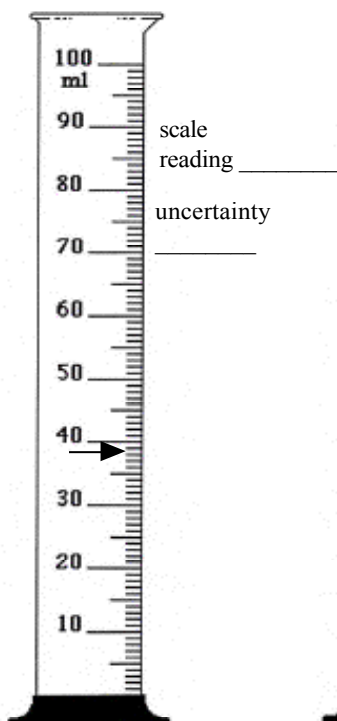
For each of the following, write the scale reading, then the number of significant figures in the reading.

		Reading	SF's
1.		_____	_____
2.		_____	_____
3.		_____	_____
4.		_____	_____
5.		_____	_____
6.		_____	_____
7.		_____	_____
8.		_____	_____

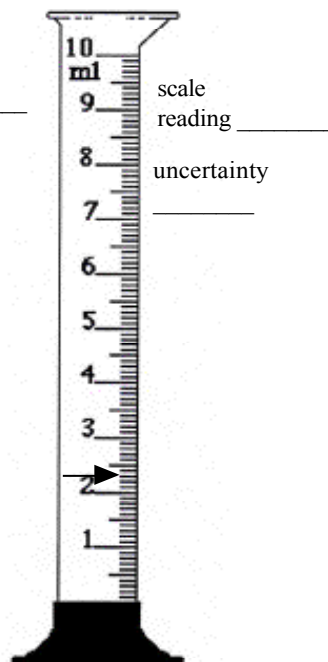
For each of the volume devices below record the scale reading and indicate the uncertainty in the measurement (\pm _____).



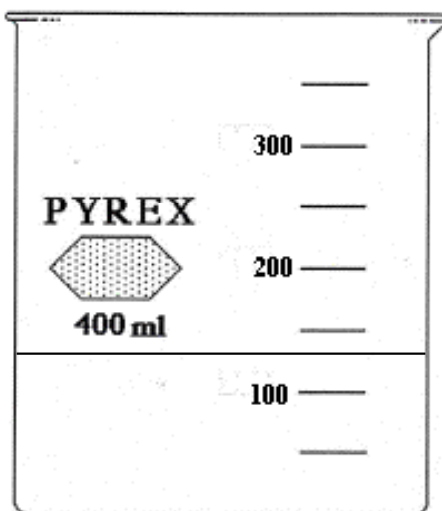
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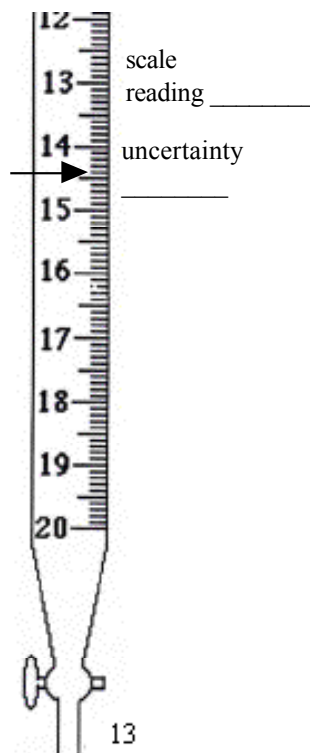


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12 scale reading _____

uncertainty _____



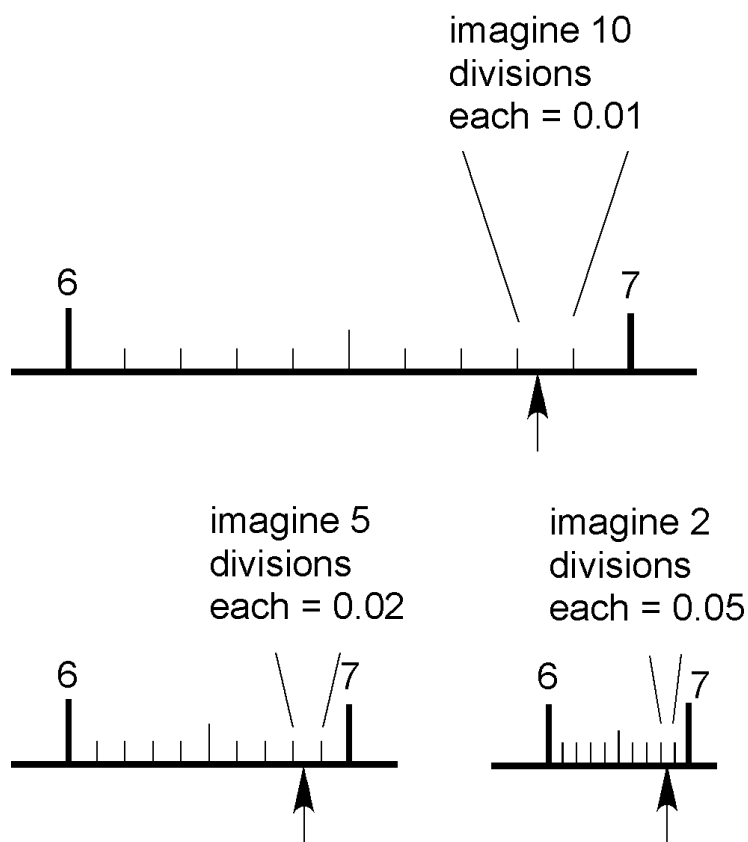
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Chemistry - Unit 1

Scale Reading, Uncertainty and Significant Figures

Significant figures – These are all the digits you know for sure + one place that is an estimate.

Uncertainty – Limit of precision of the reading (based on your ability to estimate the final digit). See examples below.



Rules for zeros: All zeros count except placeholder zeros – these are the ones that disappear when you write the number in scientific notation. Examples:

$$93,000,000 = 9.3 \times 10^7 \quad 2 \text{ sf's}$$

$$0.000372 = 3.72 \times 10^{-4} \quad 3 \text{ sf's}$$

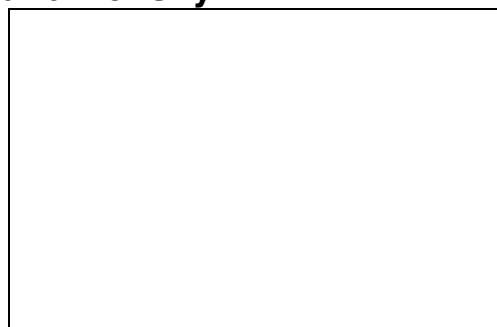
$$0.0200 = 2.00 \times 10^{-2} \quad 3 \text{ sf's}$$

Chemistry – Unit 1 Worksheet 3

Mass, Volume, and Density

1. Study the matter shown in Figure 1. Each dot represents a particle of matter. [Assume the particles are uniformly distributed throughout each object, and particles of the same size have the same mass.]

- In the table below, show how the masses, volumes, and densities of A and B compare by adding the symbol $<$, $>$, or $=$ to the statement in the second column.
- Explain your reasoning for each answer in the last column.

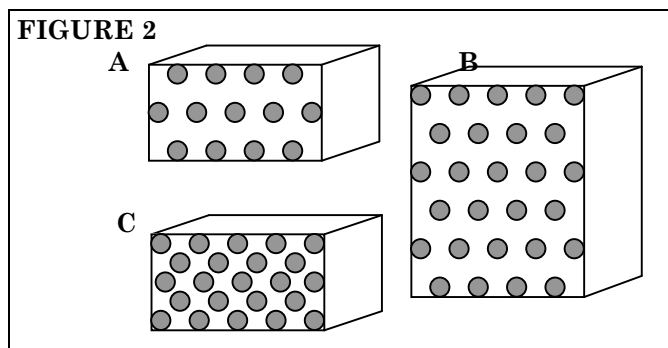


Property	Relationship	Reasoning
Mass	A ____ B	
Volume	A ____ B	
Density	A ____ B	

2. Study the matter in Figure 2. [Assume the particles are uniformly distributed throughout each object, and particles of the same size have the same mass.]

- In the table below show how the masses, volumes, and densities compare by adding the symbol $<$, $>$, or $=$ to the statement in the second column.

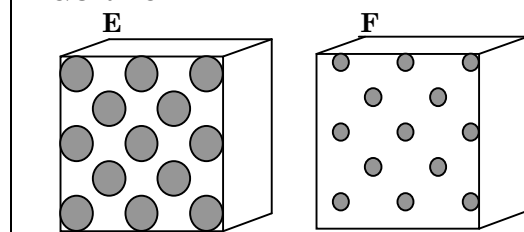
- Explain your reasoning for each



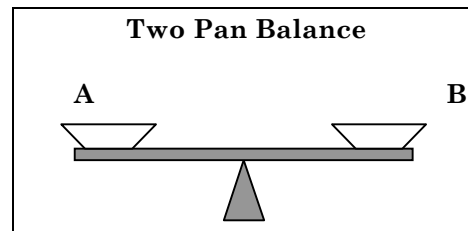
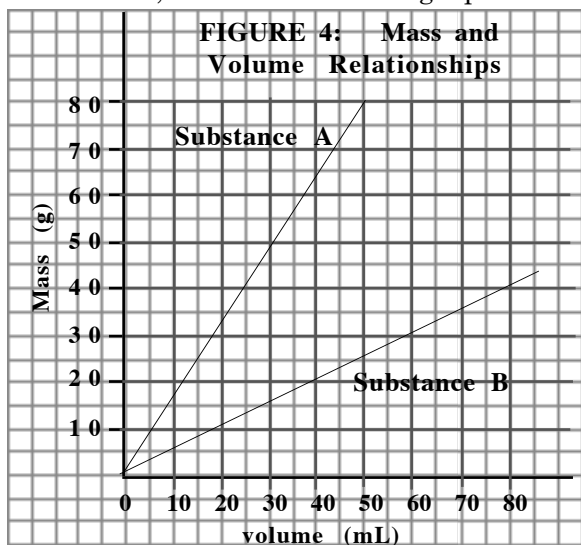
Property	Relationship	Reasoning
Mass	A ____ B	
	A ____ C	
Volume	A ____ B	
	A ____ C	
Density	A ____ B	
	A ____ C	

3. Is object E or object F more dense? [Assume the particles are uniformly distributed throughout each object, and particles with a larger size have a larger mass.] Explain your reasoning.

FIGURE 3



4. In Figure 4 below, a graph shows the relationship between mass and volume for two substances, A and B. Use the graph to answer questions about these two substances.



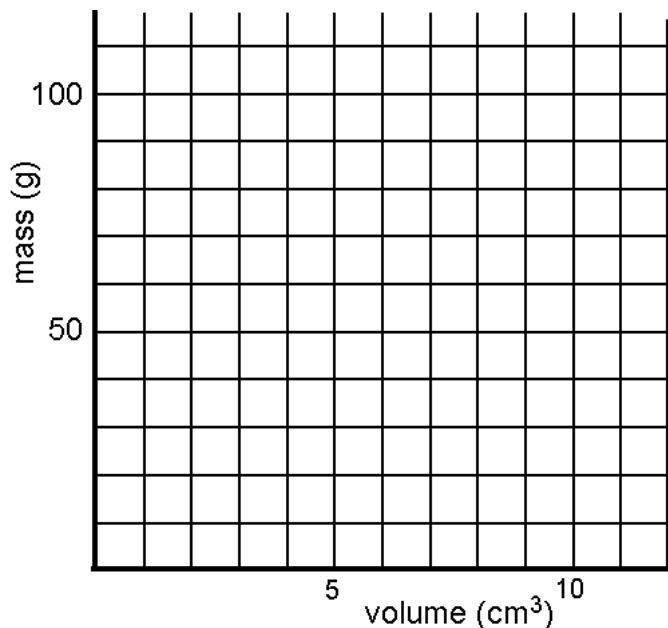
- a) You have built a simple two-pan balance shown above to compare the masses of substances **A** and **B**. What would happen to the balance if you put **equal masses** of **A** and **B** in the two pans? **Equal volumes** of **A** and **B** in the two pans? Explain your reasoning.
- b) Find the slope of the line for both A and B using correct units. State the physical meaning of the slope for each substance.
- c) If you put **10.0 mL of A** in one balance pan, how much **mass of B** would you need in the other pan to make it balance? Explain your reasoning.
- d) If you put **35.0 mL of B** in one balance pan, what **volume of A** would you need in the other pan to make it balance? Explain your reasoning.
- e) Water has a density of 1.00 g/mL. Sketch the line representing water on the graph in Figure 4.

f) Determine whether substance A and B will sink or float when placed in a bucket of water.

A: sink float B: sink float (circle correct response)

Defend your answer using the m-V graph, and your outstanding understanding of density.

Refer to the table of densities at the right to answer the following questions.



Substance	Density (g/mL)
Aluminum	2.70
Titanium	4.54
Zinc	7.13
Tin	7.31
Iron	7.87
Nickel	8.90
Copper	8.96
Silver	10.50
Lead	11.35
Mercury	13.55
Gold	19.30

5. Sketch a graph of mass vs volume for titanium, copper and mercury.

6. You made some cubes out of each metal in the table that each measures 2.00 cm on every side. (all except mercury – why can't you make a cube of mercury?)

a. What is the volume of each cube in **cm³**? in **mL**? (Show your thinking)

V = _____ cm³ V = _____ mL

b. Find the mass of these metal cubes: (Show your work below)

lead cube _____

nickel cube _____

zinc cube _____

7. Alicia's cheapskate boyfriend gave her a ring he claims is 24 carat gold. Alicia is skeptical. After chem class the next day she measures the mass of the ring, finds the volume of the ring by water displacement, and then calculates the density of the ring. Should she treasure the ring as his first truly generous gift to her, or throw it at him the next time he walks by? **Defend your answer.**

DATA:

Mass: 15.28 g
Final volume: 43.7 mL
Initial volume: 42.2 mL
Volume of ring: _____
Density: _____

8. A student filled a graduated cylinder with water and read the meniscus at 25.8 mL. The student then dropped a solid material into the graduated cylinder and the water level rose to 35.9 mL. If the solid material had a density of 2.99 g/mL, determine the mass of the solid object.

<u>Given</u>	<u>Find</u>	<u>Equation</u>	<u>Calculation</u>
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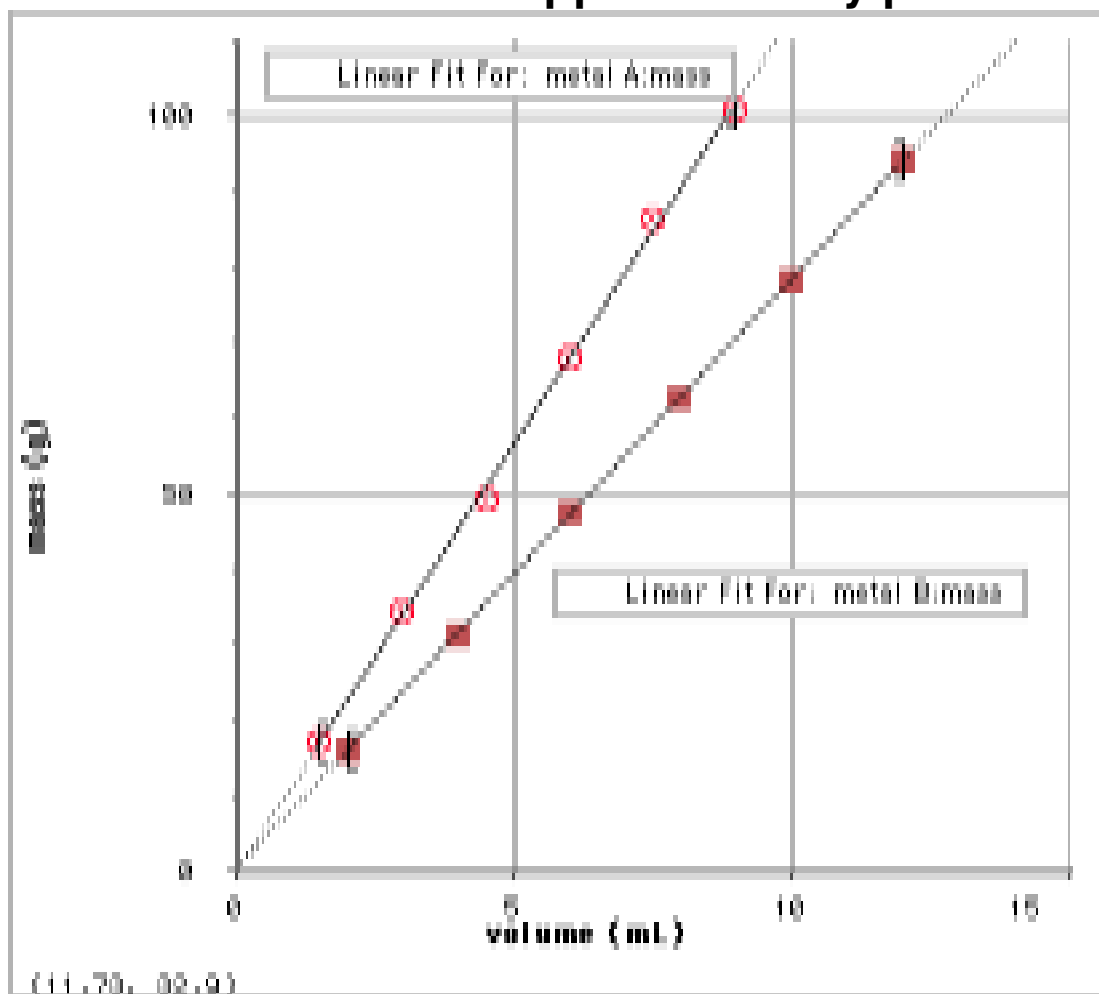
EXTRA CREDIT

Refer to the table of densities on page 3 of this worksheet to answer these questions:

You have some iron wire, copper wire, and titanium wire (all the same gauge, or diameter). Your lab group measured out a length of wire that is exactly 10.00g for each type of metal wire.

- a) Which of these 3 metal wires would be the longest?
- b) Which of these 3 metal wires would be the shortest?
- c) Explain your reasoning for answers a) and b).
- d) If every 1.0 cm length of the titanium wire has a mass of 0.15 g, how long would the 10.00g wire be? (Hint: write a conversion ratio for the two quantities you are working with)
- e) What is the diameter of the titanium wire? (Hint: diameter is related to volume; assume it is a cylinder – Geometry! Oh, yeah!)

Unit 1 Worksheet 4 – Applied density problems



- Determine the density of each metal. Show all your work and include appropriate units.
- From the graph, estimate
 - the mass of 8.0 cm^3 of metal A. _____
 - the volume of 70 g of metal B. _____
 - mark on the graph how you found the answers above
- In the space above right, use the density of B as a factor to determine the answer to 2b. Show the set-up including how the units cancel.

4. Ethanol has a density of 0.789 g/cm^3 .
 - a. What is the mass of 225 cm^3 of ethanol?

 - b. What is the volume of 75.0 g of ethanol?

5. What is the density of water in g/mL ? Why?

6. The cup is a volume widely used by cooks in the U.S. One cup is equivalent to 225 cm^3 . If 1 cup of olive oil has a mass of 205 g , what is the density of olive oil in g/cm^3 ?

7. What would you expect to happen if the cup of olive oil in question 6 is poured into a container of ethanol? Why?

Gold has a density of 19.3 g/cm^3 . A cube of gold measures 4.23 cm on each edge:

8. What is the volume of the cube?

9. What is its mass? How many significant figures should you include in your answer and why?

10. A standard backpack is approximately $30\text{cm} \times 30\text{cm} \times 40\text{cm}$. Suppose you find a hoard of pure gold while treasure hunting in the wilderness. How much mass would your backpack hold if you filled it with the gold? An average student has a mass of 70 kg . How do these values compare?

Chemistry – Unit 1 - Worksheet 6

Dimensional Analysis

Use the factor-label method to make the following conversions. Remember to use the appropriate number of sf's in your answer.

Part 1

1. 74 cm = _____ meters
2. 8.32×10^{-2} kg = _____ grams
3. 55.5 mL = _____ cm^3
4. 0.00527 cal = _____ kilocalories
5. 9.52×10^{-4} m = _____ micrometers
6. 41.0 mL = _____ liters
7. 6.0×10^{-1} g = _____ mg
8. 8.34×10^{-9} cg = _____ g
9. 5.0×10^3 mm = _____ m
10. 1 day = _____ seconds
11. 5×10^4 mm = _____ km
12. 9.1×10^{-13} kg = _____ ng
13. 1 year = _____ hours (approximately)

14. 4.22 cL = _____ mL

15. 1 mile = _____ inches

Part 2

1. How many nickels could you trade for 250 yen? \$1 = 150 yen.
2. Your school club sold 600 tickets to a chili supper. The chili recipe for 10 persons requires 2 teaspoons of chili powder? How many teaspoons of chili powder will you need altogether?
3. How many cups of chili powder will you need? Three teaspoons (tsp) equal one tablespoon (TBS) and 16 tablespoons equal 1 cup.
4. How many seconds in a year? (assume 30 days in an average month)
5. Chloroform is a liquid once used for anesthetic. What is the volume of 5.0 g of chloroform.
The density of chloroform 1.49 g/mL
6. How many inches long is a football field?
7. How many m³ is 4.6 cm³.? Express your answer in scientific notation.
8. How many mg is 59.0 kg? Express your answer in scientific notation.

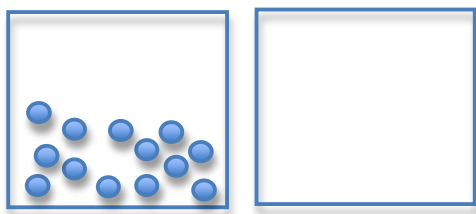
Metric Conversions With Algebra Or King Henry is Dead

Name	Symbol	Size	factor	or
nano	n	10^{-9}	$\frac{10^9 nm}{1m}$	$\frac{1m}{10^9 nm}$
micro	μ	10^{-6}	$\frac{10^6 \mu m}{1m}$	$\frac{1m}{10^6 \mu m}$
milli	m	10^{-3}	$\frac{10^3 mm}{1m}$	$\frac{1m}{10^3 mm}$
centi	c	10^{-2}	$\frac{10^2 cm}{1m}$	$\frac{1m}{10^2 cm}$
kilo	k	10^3	$\frac{1km}{10^3 m}$	$\frac{10^3 m}{1km}$
Mega	M	10^6	$\frac{1Mm}{10^6 m}$	$\frac{10^6 m}{1Mm}$

Start with a number fact, such as 4.1 cm or 0.075 mL. Examine the units of the desired answer. Multiply your fact with the factor $\frac{\text{what you want}}{\text{what you have}}$. The starting units cancel out and you end up with the desired units. Some conversions require more than one factor; e.g. we do not convert directly from kg to μg . So, the best approach is to convert from kg to g (the base unit) then from g to μg . Remember, even though we write factors with \times signs, we multiply by the numerators and divide by the denominators.

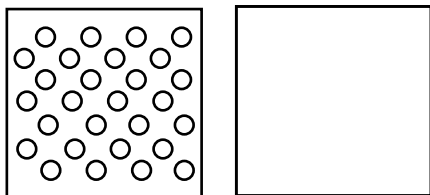
Chemistry – Unit 1 Review

1. What is the difference between mass and volume?
2. If the box at left contains atoms of aluminum in the liquid phase, represent the same atoms in the solid phase in the box at right.

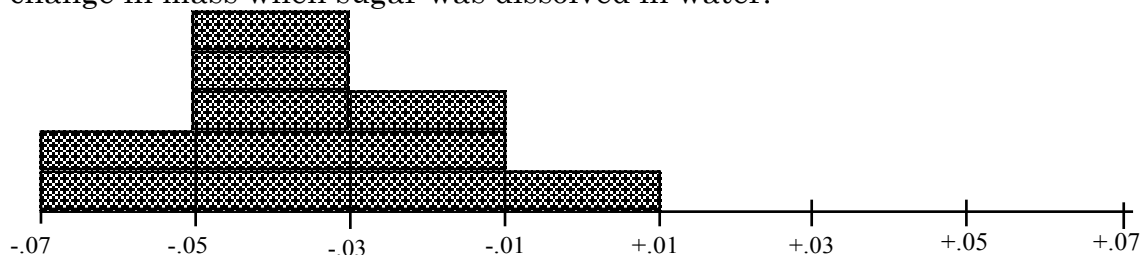


3. How would you represent the atoms of aluminum in the gaseous phase?

4. If the box at left contains atoms of iron in steel wool, represent what the atomic structure of the steel wool after strong heating in the box at right.

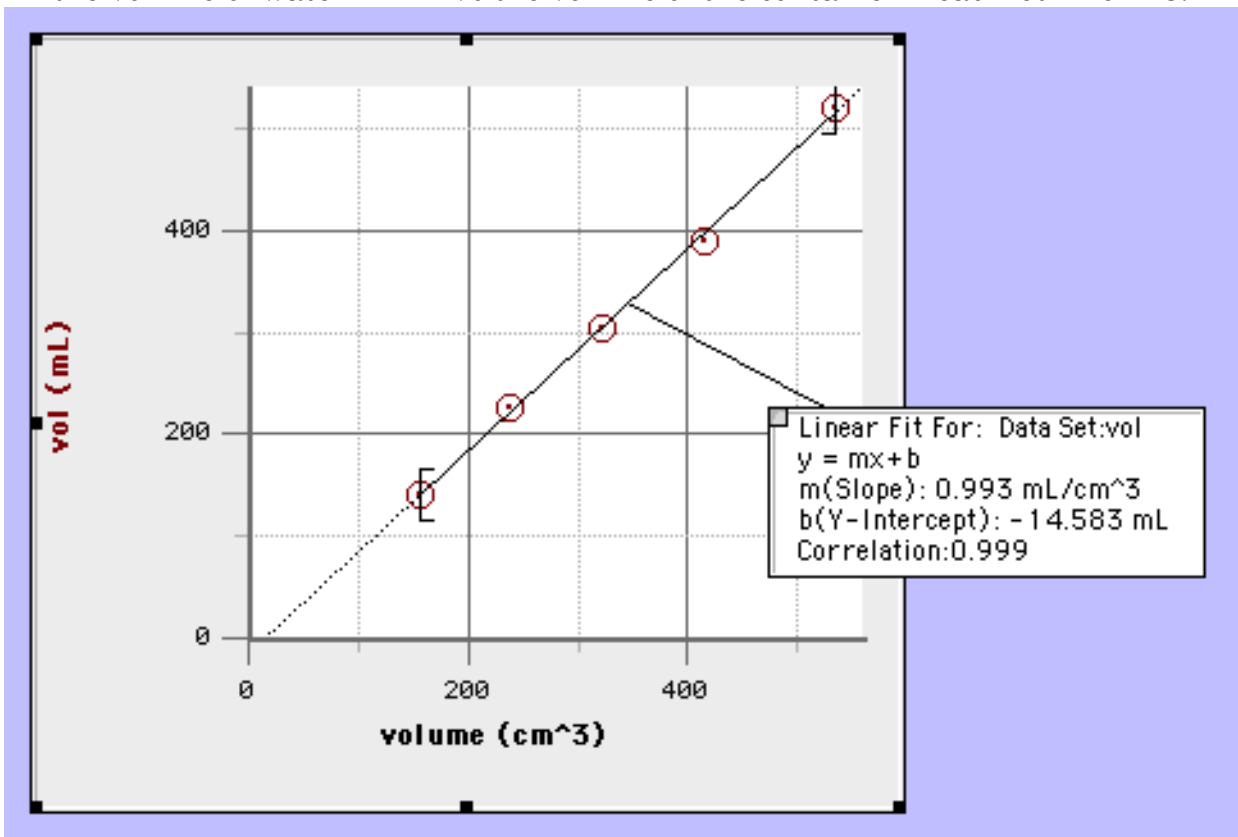


5. The 7th period chemistry class produced the histogram below to represent the change in mass when sugar was dissolved in water.



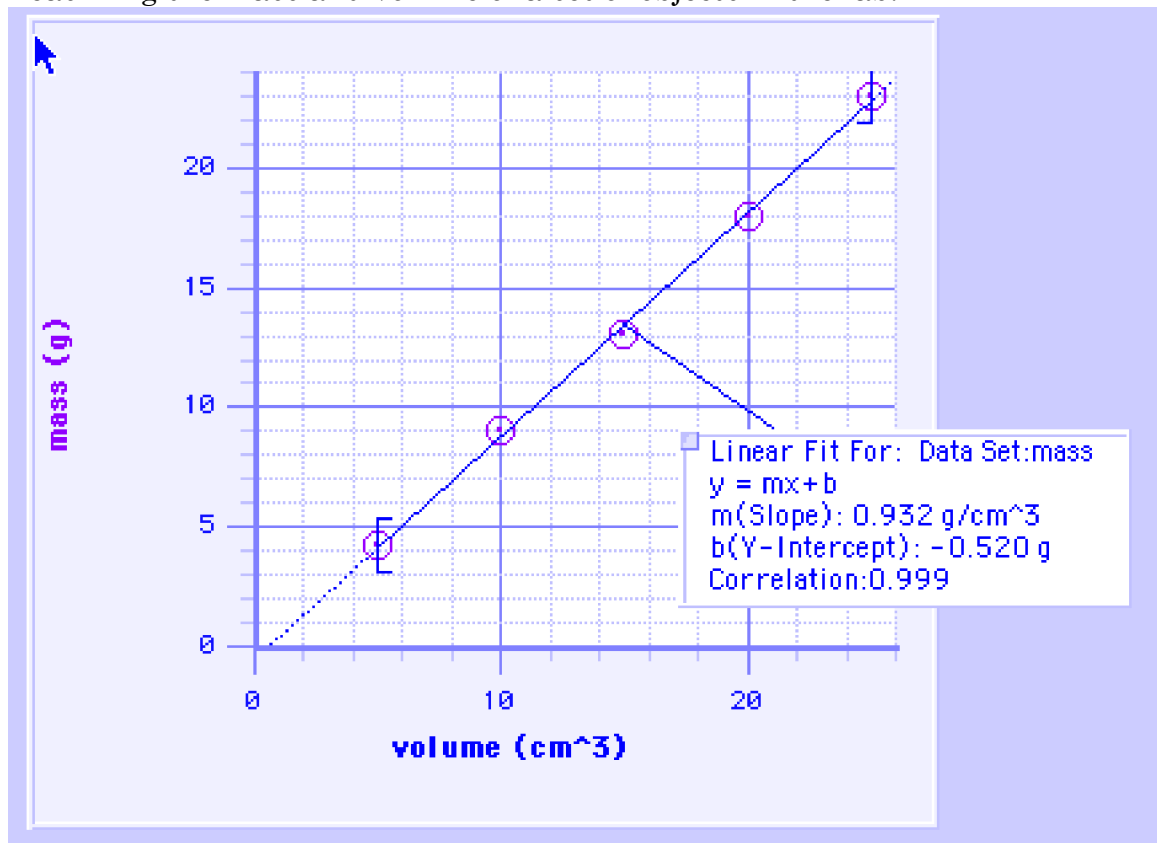
They concluded that the mass decreases slightly when sugar dissolves. Provide a better explanation.

6. The 8th period chemistry class produced the following graph when they plotted the volume of water in mL vs the volume of the container measured in cm³.



- What does the slope tell you?
- How could you account for the fact that they obtained a negative y-intercept?
- Show, using the 5% rule, whether this intercept is negligible or must be explained.

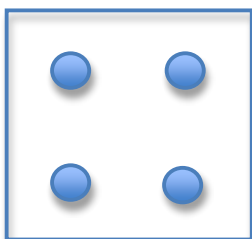
7. The 9th Hr chemistry class produced the following graph when they were measuring the mass and volume of a set of objects in the lab.



- Write the equation for the line.
- What information is given by the slope of the graph?
- Is the y-intercept negligible? Why or why not?
- What would you predict would happen if you were to put one of the objects in water? Explain.
- What would you expect to be the mass of a 45 cm³ piece of the same substance

Density Problems

8. Mercury has a density of 13.6g/mL . What is the volume occupied by 112.0 grams of mercury?
9. A cube of gold-colored metal with a volume of 54 cm^3 has a mass of 980 g . The density of gold is 19.3 g/cm^3 . Is this sample of metal pure gold? Why or why not?
10. The box on the left shows the particles of Material A. Draw in the particles for Material B if it has a density that is twice as large as Material A.



11. A block of iron with a density of 7.87 g/mL and a volume of 25 mL is stuck to a block of aluminum that has a density of 2.70 g/mL . If the total volume of the blocks stuck together is 75 cm^3 , what is the density of the new block formed from the original two?